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# THE FUTURE OF WARFARE.

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IN these days of rapid advance in what may be called the *mechanics of war*, we are constantly informed by enthusiasts that each new invention will "revolutionize" warfare. Some even declare that the increased destructiveness of war appliances renders wars impossible.

No one appliance or invention, however destructive, can do more than modify existing methods or add a new factor to the war problem. This problem remains unchanged in its underlying principles. Its successful solution can only be obtained by following ideas and rules which have remained the same from the earliest authentic historical periods. These unchanging principles may be designated the *axioms of war*. They are essentially independent of mechanical warlike appliances.

The human race must be greatly modified before it abandons war either through fear of consequences or from higher motives than those of expediency. But the improvements in war appliances, while not rendering wars impossible, tend to shorten them. The great destructiveness of these appliances, although making greater loss of life possible in a given period of time, reduces materially the *aggregate* of losses and suffering. This last is not confined to the combatants, but extends to the non-combatants, whose suffering from sympathy and actual deprivation is as poignant and real as of those actively engaged. Paradoxical as it may seem, the fiendish possibilities of destruction which the newest weapons of war open lend themselves to the amelioration of human suffering.

Modern methods and discoveries in the art of peace also tend directly to lessen suffering and loss of life in war. The necessities of modern warfare demand great strength and endurance of

troops, so that they may march long distances with rapidity, and at the same time carry a maximum of ammunition and food. Hence arises the necessity of a high degree of physical culture. Great attention is now given in all European armies to gymnastic training, resulting in the improvement of the physique. This training enables the soldier to endure more easily the demands made upon his strength. He can also withstand better the unwholesome conditions and influences which are ordinarily productive of disease, which has in the past caused greater losses of life than the weapons of the enemy.\* The future will, in this respect alone, see a decided amelioration of suffering and losses in war, compensating somewhat for the greater losses incurred in battle.

Military sanitation and hygiene have received serious attention. The soldier's clothing and equipments are being modified to protect his body fully and reduce the onerousness of burdens to be carried. His food contains all the elements of nutrition in compact form, and it is cooked so as to be palatable and digestible. The human machine is cared for so as best to conserve it under abnormal conditions and exposures.

Not alone will the improved vitality of the soldier save him from disease, but it will aid him to withstand the shock of otherwise fatal injuries. Improvements in surgery, with the wonderful benefits derived from antiseptics, will also help him to recover quickly from wounds.

To judge of the future of warfare as modified by modern improvements in war appliances, we must examine these somewhat in detail. We will first consider the weapon of the infantry, which, the smallest in size, is still the one that produces the most decisive results. The characteristics of the rifle-fire govern in a large degree the tactics of battle. The most recent developments will in the future even modify the strategic character of the conduct of campaigns.

The rifles which are now being generally adopted are all of magazine type and of a calibre varying from 0.302 to 0.315 inch. The bullet weighs less than one-half that used during our Civil War; the charge of black powder used at present is 25 per cent.

\*The report of the surgeon-general of the United States army gives the number of deaths during the Civil War as follows: from disease, 186,216; from wounds, 93,969; or nearly two to one.

greater, and the velocity imparted is about double. In addition to this, the weight per unit of area of the cross-section of the bullet being greater than before, it has greater power to overcome the resistance of the air or to penetrate any object which it may strike. Its course through the air is less curved, and the danger-space for any given range becomes much greater. In other words, the judgment as to the distance of the enemy need not be so accurate within the ordinary fighting ranges. Furthermore, it will not be necessary at the last supreme moments, when fighting within 500 or 600 yards, to make any changes in elevation. The chances of each bullet attaining a billet in the ranks of the enemy become very much increased as it sweeps along nearly parallel with the ground.

The use of the magazine rifle, permitting from five to eleven rounds to be fired in as many seconds, enables the delivery of a fire in the final critical moment which may well be called a *feu d'enfer*, and which must render the success of the attack upon intrenched troops well-nigh impossible.

So-called "automatic" rifles have been made from which it is possible to fire seven rounds in one second. In these the force of the recoil is utilized to eject the old shell and insert a new one, close the breech, and fire; this being continued until the magazine is emptied. To do all this it is only necessary to load once, cock the hammer, and pull the trigger once. The remainder of the cartridges in the magazine are then fired automatically. This having been deemed too rapid, the arm has been modified so that a separate pull of the trigger is required for firing each round, but no exertion beyond this slight bending of a forefinger is demanded. Such arms are not considered desirable because of the too rapid expenditure of ammunition. But this argument was likewise made against the introduction of single breech-loading rifles and, more recently, against the magazine rifles. As the magazine rifle has now been accepted, it is not improbable that the magazine automatic rifle will in turn meet with favor. Rifles of this class have been made which fulfil, apparently, all the requirements of service. It is, therefore, solely a question of supply of ammunition, and this will surely be provided. The use of the small-bore rifle enables the soldier to carry about 70 per cent. more rounds of ammunition than of our present service calibre.

Coupled with the rapidity of fire and improved ballistic con-

ditions, which give flatter trajectories, increased danger-zones, longer ranges, and greater penetrative powers of the bullets, there is a promise of the perfection and use of smokeless powders. If introduced, these will leave the field of view in battle unobscured. As the smokeless powders are so often mentioned, it may not be amiss to discuss them briefly. They may be divided into four classes :

- (1) Picrate class.
- (2) Nitrate-of-ammonia class.
- (3) Nitro-cellulose, or gun-cotton, class.
- (4) Nitro-cellulose and nitro-glycerine combined.

The picrate class, having picric acid as a base, have been tried very thoroughly and found unreliable. The first of the smokeless powders which were used by the French consisted of a combination of picric acid and nitro-cellulose. Combinations of chlorate or nitrate of potash with picric acid were also tried. After a number of modifications, all of which were found to deteriorate in time, this class has been abandoned.

The nitrate-of-ammonia class, consisting largely of that salt, are objectionable on account of their hygroscopic character.

Only the two remaining classes, nitro-cellulose and its combination with nitro-glycerine, appear thus far to have given good results. But we may well feel doubtful of the entire reliability and stability of any powder which contains nitro-glycerine. In the best of these defects have been developed, and no one kind has been accepted as sufficiently perfect to warrant its preparation in large quantities for future use. The smokeless powders, when acting properly, produce higher velocities, while the pressure is not too high, and, indeed, give in some cases lower pressure, than the best black powder. Being made chiefly of high explosives, they necessarily have possibilities of instability of character. One cannot but feel regarding them as one would toward a captured lion or tiger which may have been apparently tamed. Subject to control under ordinary circumstances, the natural ferocity of the beast remains latent. At any instant it may break forth and destroy the tamer who, the moment before, appeared to be its master.

Ordinary gunpowder alone appears to be worthy of full confidence. It is now used advantageously in a compressed form in small-arms ammunition, giving velocities as high as 1,900 feet per

second. Sufficient has been accomplished with smokeless powders to indicate that they may be used in small arms in future wars. Particularly will this be the case where the combatants assume that a war of long duration is out of the question, and that serious deterioration before use is not possible.

Smokeless powders are not, however, noiseless, as is so frequently stated. The noise is somewhat different from that of black powder, being on a higher key ; but it can be heard quite as distinctly and as far as when the latter is used.

The increased deadliness of fire due to better ballistic conditions and unobstructed view of the target has made it advisable for troops to secure artificial shelter when nature does not provide cover. This has caused a large percentage of the troops to be provided with portable intrenching tools. Provision is made for quickly rendering temporarily-occupied positions impregnable, by a larger supply than heretofore of wagons and carts carrying regular intrenching tools. In addition to this, there is a possibility of using small portable armored turrets, carrying quick-firing guns, for still further strengthening the key-point of a position on the battlefield. Some of these were used for this purpose in the German manœuvres of 1889 in Hanover, and they appeared to be as readily transported as pieces of field artillery. Galvanized corrugated sheet-iron arches are also provided for field use. With these, splinter-proof shelters against vertical fire can be quickly improvised at key-points of the line of battle.

Thus intrenched and armed, the question of an attack becomes a most serious one, and direct attack will not be made if avoidable. Where the ground which must be advanced over is entirely favorable to the defence, in affording an unobstructed view of the attacking forces for considerable distances, front attacks, such as have been common in previous wars, will be exceptional. Each army will endeavor, by manœuvring, to force the enemy to attack, itself choosing to do so only when the conditions of the terrain are most favorable, or only when obliged to do so by most urgent necessity.

When obliged to make the attack on an open and exposed terrain, there is now serious debate as to how such an attack had best be made. Shall it be in the extreme of open-order formation in successive clouds of skirmishers, or shall it be in closer order ? On the one hand, it is said to be impossible to keep troops under

requisite control; on the other, denser bodies are thought to be more liable to destruction by the enemy's fire.

It would appear that a combination of the two is demanded. At the longer distances, where the trajectory will be somewhat curved and the danger-zones consequently somewhat less, the formations will be in successive lines of battalions at distances from each other greater than the length of the danger-zone of bursting shrapnel. Nearer at hand they will break up into companies, still nearer into platoons, and within the last 800 yards into squads in open order, but not so far dispersed that each squad may not be held well in hand by its immediate commander. As the combat is continued and the enemy in front becomes fully occupied by the swarms of the first lines of the attack (many under cover, but near the enemy's position), the succeeding lines will advance in more compact order, moving rapidly, halting momentarily in favorable positions to gather breath and strength for the next rush, and finally all charging so as to support the broken crowd of the front of the attack by solid bodies of troops.

That such an attack cannot be made without terrific loss goes without saying. This must be anticipated and accepted from the beginning, and no attack entered into unless the means are at hand to push it to a successful conclusion, whatever may be the result. To hesitate, once having undertaken an attack, is surely to be lost. A defeat will mean more loss in the course of the repulse than could have been incurred in the aggregate had the attack been forced home to a successful conclusion. In the last stages of such an attack bodies of cavalry may well be advanced rapidly in support of the infantry, both in the direct front and in flank movements.

Successful action will in the future rest more than heretofore on the subordinate officers, including the non-commissioned officers. These will have to be most carefully selected and educated. To them must be given a great degree of consideration and authority, in order that they may command the fullest obedience and control in time of action: discipline, as applied particularly to the conditions of being under fire, should be Draconian in character, however gentle it may be at other times. The soldier must be made to feel that in retreating without orders he will not alone be subject to greater danger from the enemy, but also, if he should escape, from the action of his own authorities.

Severe action is justifiable in such cases, because success is often within the reach of troops able to make a determined and continued effort. If this is not made, all the loss to this point, and all that will surely be lost in the retreat, will have been needless. In other words, troops must be made to feel that their best chances of escape are in success.

The study of the details of terrain will be of the greatest importance in determining upon the tactics of battle. The ability to utilize accidents of the terrain in taking up positions and choosing points of attack will more than ever be an essential requisite to successful command.

Mounted troops will be used in much larger numbers than heretofore. Besides being employed for covering and observation purposes, they will be used largely where rapid movements are necessary, and to surprise the enemy by attacks on his flanks or lines of communication. The force best trained to dismount rapidly and make an attack or take up the defence on foot will undoubtedly have the greatest chance of success. Particularly will this be the case where the combat is with attacking cavalry.

A temporary madness appears to have seized European armies in the adoption of the lance for cavalry. It is difficult to ascertain upon what experiences of actual modern warfare this predilection for a weapon of the distant past is based. In the most recent battles every attack of cavalry against unbroken infantry has failed, however determinedly and recklessly made. The weapons borne by attacking cavalry appear to have been of but little importance, as success depended mainly upon the morale effect of the onrushing horses against troops already shaken. Infantry or dismounted troops will be better able to withstand a cavalry charge in the future, in view of the greater flatness of trajectory, range, and power of penetration of the new small arms, especially when combined with the advantage given to the defence by the use of smokeless powder.

The lance is a serious encumbrance, and great skill is required to use it successfully. Its range is but a short distance in advance of the rider. Its thrust may be parried. But with practice the horseman may become so skilful in the use of the revolver as to insure his hitting the human target at three to four times the distance attainable with the lance. The bullets cannot



be parried. If there is any chance of the rider approaching within thrust of the lance, there is certainly a greater chance of his coming within effective range with the revolver.

Much is said of the demoralizing effect of the rapid approach of charging horsemen. But this moral effect will be as strong when these horsemen are armed with a weapon that may not be parried and is far-reaching as when they are armed with the short-reaching lance. In the last case we may consider the horse, and the horse only, as the really effective arm and projectile which is being launched against the enemy, and success is dependent upon the extent to which this may act upon the imagination of the defence.

What has been said of the lance applies equally to the sabre. Both are encumbrances which but seldom repay the trouble of carrying them. The rare occasions when they may be successfully used are times when a well-handled revolver would be much more effective. The modern magazine carbine, giving a flatter trajectory than our present service rifle, will be the chief weapon of mounted troops.

Artillery will fill a more important part than heretofore in deciding the fate of battles. The longer range of modern field artillery, combined with the possibility of accurate measurement of ranges by improved range-finders and better time-fuses, will give it a large radius of effective action. This will also permit a wider selection of positions which may be occupied while concentrating fire upon any desired point of the enemy's line. Hence a much larger number of guns than heretofore may be simultaneously brought into action, directed by means of the telegraph and telephone.

In the Franco-Prussian War the German artillery were constantly pushed to the fore. With a gun of relatively low velocity, and with no range-finders, this was doubtless the best course to pursue, particularly as the small arms of the day had also shorter ranges than now. Neither was the fuse of that day (so necessary for successful shrapnel fire) reliable enough to warrant firing freely over their own troops. The German artillerists apparently cling to the methods and material of 1870. They ignore range-finding, and trust entirely to the expensive way of "shooting in" by the "bracket" or "fork" method. This "fork" method may be called a purely "cut-and-try" one. Percussion

shells are fired until one is seen to strike short and one beyond, and then the firing is by successive intermediate ranges until the "fork" is not longer than 50 metres. Fire is then opened with the entire battery. Fairly good results may, with very great experience, be obtained in this way if the ranges do not exceed 2,000 yards and the conditions are most favorable. How often failure results from this method is shown in the remarkable "Letters on Artillery" of Prince Hohenlohe Ingelfingen.

Artillery equipped with range-finders and accustomed to their use will have a great advantage over artillery not so supplied. A mediocre range-finder will produce better average long-range shooting than the best system of guessing and "cut and try." The difficulties involved in carrying a sufficient number of rounds of ammunition emphasize the necessity of avoiding waste and making every shot tell. It is better to take a little more time and measure the ranges, producing an immediate effective fire, than to fire rapidly, but without producing results. From one to three minutes suffices to measure a range, and the time thus taken is more than compensated for in increased effectiveness of fire. Frequent changes of position will be avoided.

Telescopic sights are necessary for the long-range work of modern field artillery. The absence of smoke will often make it difficult to detect the enemy's position and to direct accurate fire upon it. The telescopic sight will be an essential adjunct in directing the guns with sufficient accuracy to utilize the long ranges attainable.

Not alone will the use of range-finders and telescopic sights add to the certainty of artillery fire, but we may look for improvements in ammunition which will give greater uniformity of results. The cartridge-bag will be replaced by metallic cartridge-cases, hermetically sealed to protect the contents from atmospheric action. Until the smokeless powder becomes an accomplished fact, we may look for the use of compressed black powder in metallic cases, like that used so successfully in small-arms ammunition.

The longer ranges of artillery fire should indicate its use at distances beyond the effective fire of infantry, provided that the former can be delivered accurately. With improved ammunition, with range-finders, with telescopic sights and due consideration of atmospheric conditions, greater accuracy of fire should now be obtained

at 5,000 yards than was formerly obtained at 2,000 yards and less. The improvement in time-fuses will render it safe to use shrapnel fire over one's own troops, while making this most important fire more effective. Indeed, where the enemy are intrenched, as will frequently be the case, the longer range-firing may be more effective than that delivered from shorter distances, because the fire is more curved, the angle of fall being greater and having more chance of striking a covered enemy.

To attain this same end, gun-cotton bursting charges have been tried, the object being to produce the explosion just beyond the enemy's trenches and cause the fragments to fly backward. This will be met by the defence throwing up another line of breast-works in their rear, should this reverse fire annoy them.

The universal intrenching of troops when not required to be moving will undoubtedly be met by greater development, for field operations, of vertical-firing artillery. Mortar fire has heretofore been considered inaccurate. This has been largely due to inaccurate methods of pointing and loading. An increase of accuracy is now attainable and a formidable vertical fire can be delivered.

Small mortars of 3.6 or 4 inches calibre will be suitable for such work. These mortars, light and portable, carried on carts and placed on the ground when firing, can be moved wherever infantry can go. A range of at least 4,000 yards can be attained with them. Not less than 500 of these mortars could be effectively used as an arm of reserve, to be brought into action at critical times. They can be manoeuvred and their fire concentrated upon any portion of the enemy's line with a degree of facility hardly obtainable with that number of field-guns. The vertical fire enables a position to be chosen behind a hill or woods, entirely removed from the enemy's direct fire. Although such indirect fire has its difficulties, improved methods will aid in overcoming them. The demoralizing effect of a vertical fire concentrated upon any portion of the enemy's position previous to attacking by infantry will be great. The demoralization of an enemy's troops is more dependent upon considerable losses in a given short period of time than upon greater losses distributed throughout a day's fighting. For example, a loss of 3,000 inflicted on a corps of 20,000 within ten or twenty minutes will tend to demoralize the troops more than a loss of 10,000 in the course of a

day's battle. Losses inflicted upon troops lying down and apparently under cover, unable to strike back, are much more dispiriting than the loss of a larger number when they are actively engaged in retaliating upon the attacking force, or when they themselves are engaged in attacking. Such a body of field-mortars may be able to assist an attacking force for a considerable time while the latter are advancing on the enemy's position.

Should smokeless powders become available for field artillery, it will be a decided gain, as the positions occupied by the guns will usually not be sufficiently defined to permit the enemy to obtain ranges, when reasonable care is taken in placing the guns. The use of smokeless powder will most benefit the defence. If it were admissible, one would use for infantry fire smokeless powder when defending a position, and smoke-producing powder when attacking, in order, in the latter case, to obscure the field of view of the defence. To provide this veil of smoke for the attack, powder producing even a denser smoke than ordinary powder will be used as a bursting charge for shell and shrapnel fired by the attacking artillery.

Battles will no longer present the brilliant and kaleidoscopic pictures of the past. The uniforms for service will be of the least visible colors, all conspicuous ones being discarded. Gray and brown will predominate. Arms and accoutrements will be browned and lustreless. The pomp and circumstance of war will be relegated to the parade-ground in the piping times of peace.

The increased use of railroads will materially aid in shortening wars, permitting rapid concentration of troops. Each of the contestants will try to bring overwhelming numbers to the probable theatre of war, and little time will be lost in commencing active operations. Railroads were first built with reference to the requirements of commerce. In recent years old lines have been extended and new lines built solely with a view to war. This has been constantly going on throughout Europe since 1870.

We may judge more clearly of the probable influence of railroads in the future by noting the progress made. In 1806 Prussia mobilized and concentrated 145,000 men, a few marches from the centre of the state, in forty-five days. In 1866 Prussia mobilized an army of twice that number in thirteen days, and concentrated it on its frontier in eight more days. In 1870 Germany mobilized 500,000 in eight days, and in eight more concen-

trated 450,000 on the extreme frontier, much farther from the centre of the state than in 1866.

With the great extensions of the railroads since 1870 by all of the great powers of continental Europe, we may look for a rapidity of concentration far exceeding the past, and decisive actions may be expected in a very short period after a declaration of war. Thus they will shorten the duration of wars materially. A crisis in the affairs of one or the other contestant will be likely to be reached at an early date. We may look for the concentration of the armies in a single theatre of war. No contestant will be likely to scatter his forces in the face of the certainty that his opponent will concentrate all his available forces at the point where the most decisive results are likely to be obtained.

Commanders on the defence will be less likely to allow themselves to be diverted from their main purpose by any threatened attack upon distant points. They will hold their forces together and take the chances of local injuries rather than lessen their chances of defeating the main attack or change their own plan of attack.

Light portable railroads, such as the French Decauville system, will be largely used in rapidly building branches, where needed, to follow up closely the movements of troops. These will minimize the wagon trains, which would otherwise become of impossible size for the very large armies that will be used.

Besides shortening war by the rapidity with which decisive results may be obtained, the increase of railroads tends also to reduce suffering by facilitating the removal of the sick and wounded to suitable permanent hospitals and to their homes. The possibilities of recovery are thus increased far beyond what they are when the wounded are treated in field hospitals.

The telegraph, combined with portable field telegraphs, will keep a commander constantly in touch with all subordinates. The telephone, of course, will be largely employed. Battles will be directed by means of these, producing greater unity of action than would otherwise be possible for the large bodies of troops engaged.

Balloons may be used for observation purposes, but sufficient has not been accomplished to warrant the assumption that they will be able to go where desired. Their dirigibility and powers

of locomotion are not as yet sufficiently developed to make them generally useful. They may be sometimes used for observation purposes, but, with modern artillery and range-finders, they must ascend to heights of two or three miles to be out of reach of effective fire. At altitudes which may be considered safe balloon observations will be of little value. Especially is this the case in hilly and wooded countries. Captive balloons may be used for short, momentary observations, but even this is only possible where the wind is less than ten miles per hour. Beyond this velocity, unless the balloon has an extraordinary surplus of buoyancy, it will be beaten down by the wind. To have sufficient buoyancy to withstand a moderate breeze, balloons must be so large that, with the necessary apparatus, they will be cumbersome to transport and difficult to fill, and will afford excellent targets for the enemy's gunners.

Photography is to play an important part among the auxiliaries of war. Reports of reconnoissances will present to the eye of the commander the very scenes of different parts of a proposed field of operation, and he will be able to judge at a glance that which would have taken some time to grasp if limited to the ordinary field notes of a military reconnoissance.

Nothing but the most careful study and preparation to meet the complex character of all combinations of contingencies in future warfare can give any reasonable assurance of success. The commander who does not do his utmost to prepare all of the factors of his forces for the most intelligent and strenuous exertions, but trusts only to the inspirations of his genius when the critical moments shall arrive, will surely be defeated. Genius alone will not enable him to conquer an opponent whose officers and men have had superior training and whose equipment of material may also be superior.

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